cardiac signal from the patient, to determine from the signal whether the patient is experiencing atrial fibrillation, and to enable the shock generator if the patient is experiencing atrial fibrillation.

REMARKS

Claims 1-23 are pending, and claims 20-21 are allowed. The Applicants have amended claims 1-4, 6-9, 11, 13 and 16-17, and have added new claims 22-23. As discussed below, in addition to the allowed claims 20-21, claims 1-19 and 22-23 are in condition for allowance.

Rejection of Claims 1-2, 10, 12, and 18-19 Under § 103(a) As Being Unpatentable Over U.S. Patent 5,207,219 to Adams

These claims are patentable as discussed below.

Claim 1

Claim 1 as amended recites an atrial defibrillator having a shock generator operable to shock a patient in response to a shock command from an operator.

Conversely, Adams neither discloses nor suggests an atrial defibrillator that shocks a patient in response to a shock command from an operator. Adams merely discloses automatically shocking a patient without an operator's input if atrial defibrillation is detected.

Claim 2

Dependent claim 2 further recites a control device operable to receive the shock command from the operator and to activate the shock generator in response to the shock command.

Conversely, Adams neither discloses nor suggests such a control device.

Furthermore, claim 2 is patentable by virtue of its dependence on claim 1.

Claims 10 and 12

Claims 10 and 12 are patentable by virtue of their respective dependencies from claim 1.

Claims 18 - 19

Claims 18 and 19 are patentable by virtue of their respective dependencies from claim 13. The patentability of claim 13 is discussed below.

Rejection of Claims 13 and 17

These claims are patentable as discussed below.

Claim 13

Claim 13 is patentable for reasons similar to those discussed above in support of the patentability of claim 1.

Claim 17

Claim 17 recites a method that includes determining that a patient is not in atrial fibrillation if the patient's heart rate is outside of a predetermined range.

Conversely, the Examiner has cited to no reference that discloses or suggests determining that a patient is not in atrial fibrillation if his/her heart rate is outside of a predetermined range.

Furthermore, the Applicants did not amend claim 17 for reasons related to patentability, but merely to provide a claim that has the same scope as the

original dependent claim 17 in light of the amendment to claim 13, from which original claim 17 depended.

Rejection of Claims 5 and 14 Under § 103(a) As Being Unpatentable Over Adams in View of U.S. Patent 5,824,033 to Ferrari

These claims are patentable as discussed below.

Claim 5 and 14

Claims 5 and 14 are patentable by virtue of their dependencies on claims 1 and 13, respectively.

Rejection of Claims 6, 11, and 15 Under § 103(a) As Being Unpatentable Over Adams in View of U.S. Patent 6,141,581 to Olson

These claims are patentable as discussed below.

Claim 6

Claim 6 recites an atrial defibrillator is operable to determine that a patient is experiencing atrial fibrillation if a difference between the lengths of contiguous R-R intervals exceeds a threshold.

Conversely, Olson neither discloses nor suggests detecting atrial fibrillation in the claimed manner. Referring to column 15, lines 23-45, Olson first calculates the differences RPΔ between the lengths of R-P intervals within contiguous R-R intervals and the differences RRΔ between the lengths of the contiguous R-R intervals — thus a difference RRΔ is equivalent to "a difference between the lengths of contiguous R-R intervals" as recited in the previous paragraph. Next, Olson calculates a respective absolute value $|RP\Delta - RR\Delta|$ for each of the R-R intervals. Then, Olson sums these absolute values for the preceding 10 R-R intervals, and compares this sum, not RRΔ, to a threshold; if

this sum exceeds the threshold, then Olson detects atrial fibrillation. Therefore, although Olson does calculate RRΔ, it does not compare RRΔ to a threshold, and, consequently, does not and cannot determine that a patient is experiencing atrial fibrillation by determining if RRΔ exceeds a threshold.

Furthermore, the Applicants did not amend claim 6 for reasons related to patentability, but merely to provide a claim that has the same scope as the original dependent claim 6 in light of the amendment to claim 1, from which original claim 6 depended.

Claim 11

Claim 11 recites an atrial defibrillator operable to determine that atrial fibrillation is terminated if a difference between the lengths of contiguous R-R intervals is less than a threshold.

Conversely, Olson neither discloses nor suggests detecting the termination of atrial fibrillation in the claimed manner. As discussed above in support of claim 6, although Olson calculates differences RRΔ between the lengths of contiguous R-R intervals, it does not compare RRΔ to a threshold. Consequently, Olson does not and cannot determine that a patient's atrial fibrillations have terminated by determining if RRΔ is less than a threshold.

Furthermore, the Applicants did not amend claim 11 for reasons related to patentability, but merely to provide a claim that has the same scope as the original dependent claim 11 in light of the amendment to claim 1, from which original claim 11 depended.

Claim 15

Claim 15 recites determining that a patient is not in atrial fibrillation if a difference between the lengths of contiguous R-R intervals is less than a threshold.

Consequently, claim 15 is patentable for reasons similar to those discussed above in support of claim 11.

Furthermore, claim 15 is patentable by virtue of its dependency from claim 13.

Allowable Subject Matter

The Applicants have rewritten allowable-but-objected-to claims 3 – 4, 7 – 9, and 16 in independent form. Therefore, these claims are allowable.

New Claims 22 – 23

Claim 22

Claim 22 is patentable by virtue of its dependency from allowed claim 20.

Claim 23

Claim 23 is patentable because as far as the Applicants can tell, none of the cited references discloses or suggests an atrial defibrillator operable to shock a patient with a multi-phasic waveform.

CONCLUSION

In light of the foregoing and in addition to allowed claims 20-21, claims 5, 10, 12, 14-15, and 18-19 as previously pending, claims 1-4, 6-9, 11, 13 and 16-17 as amended, and new claims 22-23 are in condition for full allowance, and that action is respectfully requested.

PAYMENT OF FEES

Applicant has filed this response within the three-month period for response. If additional fees are due as a result of this amendment, Applicant

has enclosed payment. However, in the event that the Patent Office determines that additional fees are required, authorization is provided to charge such additional fees to Deposit Account 07-1897.

If the Examiner believes that a phone interview would be helpful, he is respectfully requested to contact the Applicants' attorney, Bryan Santarelli, at (425) 455-5575.

DATED this 20th day of September, 2001.

Respectfully submitted,

GRAYBEAL JACKSON HALEY LLP

Bryan A. Santarelli
Attorney for Applicant
Registration No. 37,560
155-108th Avenue N.E., Ste. 350
Bellevue, WA 98004-5901
(425) 455-5575

New Correspondence Address:
Patent Counsel
PHILIPS ELECTRONICS N.A. CORP.
Philips Corporate Intellectual Property
580 White Plains Road
Tarrytown, New York 10591

MARKED-UP COPY OF AMENDED CLAIMS

Marked up claims 1-4, 6-9, 11, 13, 16-17:

1. (Amended) An atrial defibrillator, comprising:

a portable, non-implantable housing;

a pair of defibrillator pads operable to be applied to the outside of a patient's body;

a shock generator disposed in the housing, coupled to the pads, and operable to shock the patient via the pads in response to a shock command from an operator; and

an analyzer disposed in the housing and operable to receive a cardiac signal from the patient, to determine from the signal whether the patient is experiencing atrial fibrillation, and to enable the shock generator if the patient is experiencing atrial fibrillation.

2. (Amended) The atrial defibrillator of claim 1, further comprising a control device disposed in the housing, ~~and~~ coupled to the shock generator, and operable to receive the shock command from the operator and to activate the shock generator in response to the shock command.

3. (Amended) An atrial defibrillator, comprising:

a portable, non-implantable housing;

a pair of defibrillator pads operable to be applied to the outside of a patient's body;

a shock generator disposed in the housing, coupled to the pads, and operable to shock the patient via the pads;

an analyzer disposed in the housing and operable to receive a cardiac signal from the patient, to determine from the signal whether the

patient is experiencing atrial fibrillation, and to enable the shock generator if the patient is experiencing atrial fibrillation; and

~~The atrial defibrillator of claim 1, further comprising~~ a safety device disposed in the housing and operable to prevent the patient from activating the shock generator.

4. (Amended) An atrial defibrillator, comprising:

a portable, non-implantable housing;

a pair of defibrillator pads operable to be applied to the outside of a patient's body;

a shock generator disposed in the housing, coupled to the pads, and operable to shock the patient via the pads;

an analyzer disposed in the housing and operable to receive a cardiac signal from the patient, to determine from the signal whether the patient is experiencing atrial fibrillation, and to enable the shock generator if the patient is experiencing atrial fibrillation; and

~~The atrial defibrillator of claim 1, further comprising~~ a verification device disposed in the housing and operable to prevent an unauthorized person from activating the shock generator.

6. (Amended) An atrial defibrillator, comprising:

a portable, non-implantable housing;

a pair of defibrillator pads operable to be applied to the outside of a patient's body;

a shock generator disposed in the housing, coupled to the pads, and operable to shock the patient via the pads;

an analyzer disposed in the housing and operable to receive a cardiac signal from the patient, to determine from the signal whether the

patient is experiencing atrial fibrillation, and to enable the shock generator if the patient is experiencing atrial fibrillation;

~~The atrial defibrillator of claim 1~~ wherein:

the cardiac signal comprises an electrocardiogram having R-R intervals; and

the analyzer is operable to determine whether the patient is experiencing atrial fibrillation by;

measuring the durations of the R-R intervals,

calculating the respective differences between the lengths of contiguous ones of the R-R intervals,

comparing the calculated differences to a difference threshold, and

determining that the patient is experiencing atrial fibrillation if one of the calculated differences exceeds the threshold.

7. (Amended) An atrial defibrillator, comprising:

a portable, non-implantable housing;

a pair of defibrillator pads operable to be applied to the outside of a patient's body;

a shock generator disposed in the housing, coupled to the pads, and operable to shock the patient via the pads;

an analyzer disposed in the housing and operable to receive a cardiac signal from the patient, to determine from the signal whether the patient is experiencing atrial fibrillation, and to enable the shock generator if the patient is experiencing atrial fibrillation;

~~The atrial defibrillator of claim 1~~ wherein:

the cardiac signal comprises an electrocardiogram having R-R intervals; and

wherein the analyzer is operable to determine whether the patient is experiencing atrial fibrillation by;

measuring the durations of a first group of the R-R intervals,

calculating the respective differences between the durations of contiguous ones of the R-R intervals in the first group,

comparing the calculated differences to a difference threshold,

repeating the measuring, calculating, and comparing for a second group of the R-R intervals, and

determining that the patient is experiencing atrial fibrillation if one of the first-group differences and one of the second-group differences exceed the threshold.

8. (Amended) An atrial defibrillator, comprising:

a portable, non-implantable housing;

a pair of defibrillator pads operable to be applied to the outside of a patient's body;

a shock generator disposed in the housing, coupled to the pads, and operable to shock the patient via the pads;

an analyzer disposed in the housing and operable to receive a cardiac signal from the patient, to determine from the signal whether the patient is experiencing atrial fibrillation, and to enable the shock generator if the patient is experiencing atrial fibrillation;

~~The atrial defibrillator of claim 1, further comprising:~~

a memory coupled to the analyzer and operable to store a normal QRS signal of the patient;

wherein the cardiac signal comprises an electrocardiogram having QRS signals and R-R intervals; and

wherein the analyzer is operable to determine whether the patient is experiencing atrial fibrillation by;

measuring the durations of the R-R intervals,

calculating respective R-R differences between the lengths of contiguous ones of the R-R intervals,

comparing the calculated R-R differences to an R-R threshold,

calculating a QRS difference between one of the QRS signals of the cardiac signal and the stored QRS signal,

comparing the calculated QRS difference to a QRS threshold, and

determining that the patient is experiencing atrial fibrillation if one of the R-R differences equals or exceeds the R-R threshold and the QRS difference is less than the QRS threshold.

9. (Amended) An atrial defibrillator, comprising:

a portable, non-implantable housing;

a pair of defibrillator pads operable to be applied to the outside of a patient's body;

a shock generator disposed in the housing, coupled to the pads, and operable to shock the patient via the pads; and

an analyzer disposed in the housing and operable to receive a cardiac signal from the patient, to determine from the signal whether the patient is experiencing atrial fibrillation, and to enable the shock generator if the patient is experiencing atrial fibrillation;

~~The atrial defibrillator of claim 1 wherein:~~

the cardiac signal comprises an electrocardiogram having R-R intervals; and

wherein the analyzer is operable to determine whether the patient is experiencing atrial fibrillation by;

measuring the durations of the R-R intervals,

calculating respective differences between the lengths of contiguous ones of the R-R intervals,

comparing the calculated differences to a difference threshold,

determining the patient's heart rate,

determining whether the patient's heart rate is within a predetermined range of heart rates, and

determining that the patient is experiencing atrial fibrillation if one of the differences exceeds the threshold and the heart rate is within the predetermined range.

11. (Amended) An atrial defibrillator, comprising:

a portable, non-implantable housing;

a pair of defibrillator pads operable to be applied to the outside of a patient's body;

a shock generator disposed in the housing, coupled to the pads, and operable to shock the patient via the pads;

an analyzer disposed in the housing and operable to receive a cardiac signal from the patient, to determine from the signal whether the patient is experiencing atrial fibrillation, and to enable the shock generator if the patient is experiencing atrial fibrillation~~The atrial defibrillator of claim 1~~

wherein:

the cardiac signal comprises an electrocardiogram having R-R intervals; and

wherein the analyzer is further operable to determine from the

cardiac signal whether the atrial fibrillation terminates after the shock generator shocks the patient by;

measuring the lengths of the R-R intervals,

calculating respective differences between the lengths of contiguous ones of the R-R intervals,

comparing the calculated differences to a difference threshold, and

determining that the atrial fibrillation is terminated if one of the calculated differences is less than the difference threshold.

13. (Amended) A method, comprising:

receiving a cardiac signal from a patient;

determining from the signal whether the patient is experiencing atrial fibrillation;

receiving a shock command from an operator; and

shocking the patient with a portable shock generator in response to the shock command if the patient is experiencing atrial fibrillation.

16. (Amended) A method, comprising:

receiving a cardiac signal from a patient;

determining from the signal whether the patient is experiencing atrial fibrillation;

shocking the patient with a portable shock generator if the patient is experiencing atrial fibrillation;~~The method of claim 13, further comprising:~~

storing a normal QRS signal of the patient; and

wherein the determining comprises;

measuring the lengths of R-R intervals of the cardiac signal,

calculating the respective differences between the lengths of contiguous ones of the R-R intervals,

comparing the calculated differences to an R-R threshold,

calculating a difference between a QRS signal of the cardiac signal and the stored QRS signal,

comparing the calculated QRS difference to a QRS threshold, and

determining that the patient is not in atrial fibrillation if one of the calculated differences is less than the R-R threshold or if the QRS difference is greater than or equal to the QRS threshold.

17. (Amended) A method, comprising:

receiving a cardiac signal from a patient;

determining from the signal whether the patient is experiencing atrial fibrillation;

shocking the patient with a portable shock generator if the patient is experiencing atrial fibrillation; and~~The method of claim 13~~

wherein the determining comprises~~,~~:

determining the patient's heart rate~~,~~; and

determining that the patient is not in atrial fibrillation if the heart rate is outside of a predetermined range.